# *An Account of ſome* Experiments *made at ſeveral* Meetings *of the* Royal Society *by the Ingenious* Fred. Slare *M. D.* Fellow *of the* Royal Society, *and one of the* Colledge *of* Phyſitians, *with ſome ſhort applications of them to* Phyſical *matters.*

## Experiment I.

### *A Parallel betwixt* Lightning *and a* Phoſphorus.

1. IN order to the keeping my *ſolid Phoſphorus* from conſuming, I uſually plac'd it at the bottom of a Glaſs of *Water*: having ſeveral of theſe Glaſſes diſpoſed upon a Table in view whilſt I lay upon my Bed, I could obſerve ſeveral *flaſhes* of *Light* that ſucceſſively paſt through the *Water*, and made ſuch bright, and vigorous *Coruſcations* in the Air, as would ſurprize and affrighten one not uſed to the *Phænomenon.* This fiery *Meteor* paſſes ſomething contracted through the incumbent *Water*, but expands it-ſelf much as ſoon as it gets above it. If you would make theſe *Experiments* to advantage, the Glaſs ought to be deep and Cylindrical, and not above Three-quarters fill'd with water.

If we compare theſe appearances with *Lightning*, we may obſerve that *Lightning*, which comes at *Intervalls* paſſes uninterrupted the moſt condenſed *Clouds*, and is not extinguiſhed or obſtructed by the greateſt Storms or Catarracts of water, but like the Beams of the Sun or any other fire freely paſſes through Glaſs and water.

2. This *Phoſphorus* in the mentioned ſtate only emitts theſe *Flaſhes* of *Light* in warm weather, a certain temper of the *Air* being neceſſary to produce the *effect*, for in the *Winter* or cold weather I never obſerved it.

The warm ſeaſon of the *Summer* is moſt productive of of *Lightning*.

3. The mention'd *Flaſh* of *Light* is not apt to kindle or burn any combuſtible matter, as I found by holding my finger in it unmoleſted, but not truſting to that, I held in the flame, *Paper*, *Flax*, and ſuch Materials as are apt to take fire, which it did no more than when we projected the *Light* of the *Moon* by a *Concave Glaſs*, upon the like bodies.

Such an inoffenſive *Flame* that of *Lightning* is generally obſerved to be, But

4. The matter of the *Phoſphorus*, whilſt in a more condenſed body, will eaſily be *accended* by the warmth of the *Air*, or by the immediate *Beams* of the *Sun*, and then will burn very furiouſly with ſuch a penetrating fire as will not eaſily be extinguiſhed.

Thus *Lightning*; when condenſed or contracted, and wrapt up in a *Vehicle* of *Air*, ſo that it does not ſo eaſily diffuſe it ſelf through the yielding *Æther*; will then ſet fire to *Houſes*, *Trees*, &c, and do great miſchief.

5. Our matter whilſt burning acts the part of *Corroſive*, and when it goes out it reſolvs into a *Menſtruum* that diſſolves *Gold*, *Iron*, and other *Metals*.

Thus Lightning melts down, *Gold*, *Iron*, *Lead*, and other *Metals*.

Theſe *Experiments* were concluded moſt Naturally to illuſtrate

illuſtrate and reſemble the *Phænomena* of *Lightning*, farr exceeding either thoſe made with *Nitre*, *Gun-powder* or *Aurum fulminans*. As to ſome other properties of this ſhining and burning *Preparation* ſee the *Philoſophical Collections*.

### *Experiment II.*

BY mixing Two *Liquors* actually *cold* to produce ſuch *ſparkling* and *fiery* bodies, as are not only viſible in the *dark*, but at *noon day* in the enlightned Air.

This *Experiment* was not a little ſurprizing, which was thus made. We took betwixt Ten and Twenty Grains of the *ſolid Phoſphorus* and cauſed it to melt in as much water as would juſt cover it, which was about a Dram: after it was actually *cold* we poured it into two Ounces of *Oyl* of *Vitriol*, which being well ſhaken together did firſt heat, and then throw up ſuch fiery *Balls*, which like ſo many Stars will adhere to the ſides of the *Glaſs* and continue to burn for ſome time to the great pleaſure of the *Spectator*.

### *Experiment III.*

BY the addition of an *Oyl* to the foregoing *mixture* to produce a *flame*.

This is done only by pouring a ſmall quantity of *Oyl* of *Turpentine*, without ſhaking the Veſſel, the *mixture* takes fire and burns very furiouſly. This *Experiment* ought to be made in an open Veſſel where the *Air* has a free acceſs. This ſucceeded with *Oyl* of *Petroleum*, and *de Lateribus*: but *Sallet-oyl* and ſpirit of *Wine* would not be made to flame.

The Ingredients that compoſe this burning mixture are apart *cold* to the touch, and ſome of them in their *Operations*

*perations*, thus *Water* and *Oyl* of *Vitriol* are cooling in their *Nature*, but theſe in *Conjunction* cauſe a great *heat*, which ſoon excite the agile Particles of our *Phoſphorus* to an actual fire, and this Meeting with an inflamable Ingredient ſuch as *Oyl* of *Turpentine*, or the like; does produce as conſiderable a *flame* as boiling *Oyles* as wont to do.

Theſe *Experiments* would have been leſs conſiderable or ſurprizing, had that of *Borrichius* been certain (mention'd by *Bartholinus* in the *Acta Hafnienſia*) and quoted by an Ingenious *Fellow* of the *Royal Society* as credible. The *Title* of the *Experiment* being, to make two Liquors kindle one another tho apart they are actually cold.

Tho I knew it would fail of the deſired event by ſeveral unſucceſsful *Tryals* I had made, yet I was the willinger to make the *Experiment* before ſo many impartial Judges, becauſe this ſpecious *Experiment* had been impoſed not only on ſome that were preſent, but alſo on the faith of many of the *German* Nation, who ſometimes quoted it to ſerve their *Hypotheſis*. This made it neceſſary to bring it to a final *Determination*.

## *Experiment IIII.*

BEing a Refutation of *Borrichius*'s Experiment that pretends to Accenſion.

We took according to direction four Ounces of freſh drawn Spirit of *Venus Turpentine* to ſix Ounces of *Aquafortis* newly drawn and very ſtrong.

We mixed them together in a Glaſs body, and accordingly placed the Veſſel in the *Sun Beams*, (which I foretold ſome of the By-ſtanders would deceive us) after half an hours Patience the *Liquors* began to ferment very furiouſly, inſomuch that a very great Smoak was raiſed by this means which was ordered to kept down by a Cork that ſtopt the the Veſſel. This condenſed red Fume repreſented flame

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by reaſon of the *Beams* of the *Sun* that were permitted to ſhine upon it: but I was aſſured that this was a great *Fallacy*, and that the Experiment contradicted the *Proverb*, *There is no Smoak without ſome Fire.* I was willing to give the *Experiment* any advantage, which made me comply with that Circumſtance of doing it where the *Beams* of the *Sun* were admitted: but this very Circumſtance giving ground to the miſtake, I deſired leave to make the *Experiment* in a dark Room where we ſhould better diſcern any real productions of *Light*: being aſſured that the action of the *Liquors* would as certainly ſucceed in the *darken'd* Room as in a *light* One. The *Experiment* was repeated, and the action of the *Liquors* was no leſs vigorous than in the former *Experiment*. Moreover *Flax*, being lookt upon as a very combuſtible matter, was ſuſpended in the *Fume*: but in ſhort, the *Obſervers* of this *Experiment*, which were many and very *Inquiſitive*, could not diſcover the leaſt ſpark of *fire* or glimpſe of *Light*, ſo that the *Flax* remain'd untouch'd, and the *fermenting Liquors* gave no *light*, *fire*, or *flame*: only take this Caution; keep your *Candles* at a diſtance, for the Fume will ſoon take fire at any actual *flame* and ſet the *Liquors* a burning, and ſo it may impoſe upon the *Careleſs*.

### *Experiment V.*

BEing a New *Experiment* with Ebullition and incaleſcence.

Amongſt thoſe various *mixtures*, wherein great Heats and Effervencies with much Ebullition were produced, none were ſo conſiderable as this, which was alſo ſhewn at the ſame *Meeting*.

Upon an Ounce of *Spirit* of *Nitre*, if you pour two or three *Drams* gradually of the higheſt rectified *Spirit* of *Wine*, the Heat and Ebullition will be incredibly great.

And whereas in the former Experiment you muſt wait a good time for your *Efferveſcence*, here tis performed in an Inſtant ſo that I had more reaſon to expect from the mighty action of theſe *Liquors* upon each other, a production of actual fire or flame, than from *Borrichius* his *Experiment*. Poſſibly ſome may be ready to imitate this *Experiment* which may fail them, unleſs they obſerve ſome little *Directions*. Errors of this kind, have made ſome people believe they are impoſed upon when there is no ſuch thing. Common *Spirit* of *Nitre*, ſuch as was firſt diſtill'd into water, and afterwards *dephlegm'd* (or diſtill'd ſo as to have all the water ſeparated) this will fail your expectations; it muſt be the *Red Spirit* of *Nitre*, and a very high rectified Spirit of *Wine*. In the next place, you muſt firſt pour into your Glaſs the *Spirit* of *Nitre*, which is the heavier *Liquor*, and then the *Spirit* of *Wine* after, for if you invert the order you will have no Ebullition, which will not a little puzzle the reaſon of *Philoſophers*.

In this *Experiment* (eſpecially if the *Ingredients* are made very high) the *Spirit* of *Nitre* does as it were act the part of a *Coal* of *fire* : as *fire* exhales and drives up *water* that is thrown upon it, ſo does this *Spirit* of *Nitre* very furiouſly throw up a great quantity of the Vinous ſpirit, in ſo much that it preſently perfumes a Room with the ſmell: but to be more exact in this *Obſervation*, we mix'd equal parts together in a *Retort*, and then cemented a *Receiver* of good dimenſions, and ſo we condens'd that *Vapor* which riſes from this *mixture* and obtained much of our *Spirit* of *Wine* again.

Both theſe Experiments may ſerve as Arguments againſt the notion of *Acidum* and *Alkali*, ſince mighty *Conflicts* may be excited by bodies of differing *Textures* where theſe two *Principles* are not *conſpicuous*. We have here indeed very ſtrong *Acids*, but in the other never were any *Alkali's* ſuſpected whether *volatile* or *fixt*. Nor can I think that that latent *Alkali* imagined to be in the *ſpirit* of *Nitre* does produce

duce this great conflict, for I queſtion whether there be any ſuch thing; if it be an *Alkali*, it has quite loſt its property, that tis not wrought upon by ſo ſtrong an *Acid* in whoſe boſom it lyes. *Wood* may as well remain incombuſtible in a great Fire, as ſuch an *Alkali* under the power of ſo great an *Acid*. But this is only a hint.

There are various *Liquors* whoſe *mixtures* are apt to produce greater or leſſer effervefcenſcies, heats, and inflammations, ſo that particularly the great *Incaleſcence* and burnings in *Feavers* are eaſily accounted for, and made obvious by occurring *Experiments*. There ſeems more difficulty to account for ſome *cold diſaffections* of the Blood, and other *Juices* of the body. For *Hyſterical Perſons* will complain of a great *Chilneſs* or *Froſt* in the *Blood*, during that *Paroxyſm*, ſuch as a good *fire* and warm *Cordials* will not eaſily conquer. In theſe *Perſons* the *Pulſe* is always very tardy, (differing from what I have obſerved in *Agues* where in the *Cold Fit* it has been very quick.) This may be better explicated by a ſolution of *Sal Armoniack* than of *Nitre* in water.

## *Experiment VI.*

OF Cold produced without Ebullition, giving ſome account of Hyſterical Paroxyſms.

In about a Pint of water we diſſolved a Quarter of a Pound of *Sal Armoniack*, which was found to be ſo very *cold* to the *Touch* that we needed no *Weather Glaſs* to convince us of the *effect*.

In this *Experiment* we have no Ebullition or *Swelling* of the Liquors, but rather a *condenſation*, which may alſo happen in the *Hyſterical frigid Paroxyſm*, for in caſe the humours ſwell'd they would require more ſpace, which perhaps is not to be allow'd, but muſt then be compenſated by the *acceleration* of the *Pulſe*, which would then be obliged to tranſmit the extended humours in a ſhorter time, but this is not our caſe here, but referrs to the next. I here chooſe to explain the *affections* of the blood by the *ſolution* of *Sal Armoniack* that (as we ſaid) in our *Experiment)* affected the *Blood* of thoſe *Perſons* that long touched it, with a ſenſible and troubleſom degree of *cold*. For the Maſs of *Blood* may be very apt to degenerate into ſuch *Concretions* as do much reſemble *Sal Armoniack*; and this will ſeem more probable if we conſider that *humane* and *other* blood naturally abounds with *Urinous Salts*, and do preternaturally degenerate into Acrimonious and Pungent *Juices*, which may be much promoted by a too liberal uſe of high ſeaſon'd or *ſalted* Meat, and *ſour* Liquors. For this we find by *Experience* that ſuch an *acid* as *Spirit* of *Salt* mixing with an *Urinous*, will be converted into *Sal Armoniack* (which has now loſt much of its *Volatile* Nature) This we may plainly diſcern by its *ſhooting* into a *Figure*, that reſembles *Feathers*, which is proper to *Sal Armoniack*. That the blood does abound with various ſorts of *Salt* 'tis not to be doubted, and that it has ſuch a *Salt* as ſome call *Salſum*, which is *Sea-ſalt*, I lately exhibited at the *Royal Society*, and laſtly that *Sal Armoniack* has its principal dependance on great quantities of *Volatile Salt* (ſuch as the *blood* is ſtored with) and on this mention'd *Salt*, 'tis very well known. So that having preſuppoſed ſuch *Concretions* as theſe to have their *exiſtence* in the *blood*, we muſt conſider how they come to act. That there may be ſome *antecedent* and other *Concomitant Cauſes* of *Hyſterical Paſſions*, I do not deny; I only or principally conſider the cauſe of the *cold affections*.

'Tis very probable that the *Glands* do ſuffer great *obſtructions*, which are *antecedent* to this *Paroxyſm*: I am the rather inclined to this opinion, by reaſon of ſo great a *Thirſt* our *Patients* are apt to complain of before and in the *Fit*: by which *obſtructions* the uſual *Secretions* of the *Lympha* are hindred as well from watering the the *Mouth* as the *Oeſophagus* and *Stomack*, which cauſes *Thirſt*. Moreover the leſs quantity of *Lympha* is evacuated the uſual way, the more is abſorbed by the *Veins*, which does ſo dilute thoſe *Salts* in the *Maſs* of *blood* as brings them to a *Fluor* or ſuch a *Solution* as is neceſſary to give the *cold Effect*. Thus *Sal Armoniack* will mix with ſome *Liquors* and not with *others*, ſcarce at all with *Spirit* of *Wine*, and not ſo well with *Wine* as *Water*, and the more *limpid* the *Water* is, the better and ſooner it *diſſolves*, and to this *Menſtruum* does eſpecially impart this *cold Operation*. Which not unreaſonable conjecture of an extraordinary effuſion of *Lympha* into the Maſs of Blood at ſuch a time, is farther confirm'd by that great quantity of *Vrine* thoſe *Perſons* are apt to make: which has made ſome fear a *Diabetes* that have not been well verſed in ſuch *Caſes*: for the *Vrine* here will look very *pale* and *limpid*. And this may be further proved that when the *Cuticular Glands* are hinder'd from doing their tranſpiring office, particularly by any cold ambient Fluid which happens to them that go into water, that then they are obliged to throw off greater quantities of *Vrine*, which has been obſerved by me to be very *pale* and *inſipid*, after a ſecond or third *Evacuation*. But I muſt not be too tedious.

### *Experiment VII.*

OF Cold produced by a very great Ebullition wherein the cold and hot *Fits* of an *Ague* are reſembled by a mixture of *Liquors*.

If we uſe in this *Experiment* any *Acid*, whether of Vinegar, Verjuice, Wood Sorrel, Oranges, Limmons, or perhaps yet milder ones, by caſting into theſe *Juices* a *volatile Salt* of *Human Blood*, I always obſerved a notable Ebullition would enſue, which I never could find would heat as ſuch boiling Liquors are apt to do (and one would expect they ſhould ) but on the contrary affected a good *Weather Glaſs* ſo as to make the *Liquor* deſcend, which was a manifeſt token of *Cold*. There I found that the higher the *Acid* was, the greater the *Ebullition* and the *Cold* would be, which is very remarkable. For this very Reaſon I made uſe of very ſtrong *Vinegar*, dephlegm'd by *freezing* (which way is taught by the Honourable Mr. *Boyle*, to whoſe great favors and manuduction I muſt aſcribe whatever ſervice I ſhall be able to do *Experimental Philoſophy)* by this *mixture* we came much nearer the *freezing* Point. But ſince it proves troubleſom to prepare this *Vinegar*, and becauſe it can be done only at *certain times*, I have moſt commonly made the *Experiment* with Spirit of *Venus*, or *Verdigreaſe*, which is the higheſt *Vinegar* in the world: with this the *Cold* will be moſt ſenſible to the *Touch*, and moſt conſpicuous on the *Weather Glaſs*. For by this *mixture* I have in *Summer* made a *Weather Glaſs* to deſcend below the *Temperament* of cold Fountain water, *ſix Inches* at leaſt, which brought it ſo near the *freezing* mark that it ſcarce wanted *half* an *Inch*. But at the ſame time the *Liquor* ſwells and takes up more room than before, and will not be contained in *ſhallow* Veſſels. In this Experiment we have ſome things very rare, that a great and violent motion of two *diſſenting Liquors*, ſhould be ſo far from producing *Heat* as to produce a notable degree of *Cold*, and that too with a conſiderable expanſion of their parts. Here we might inſtance in an appoſite and as unexpected an *Experiment*, where an effect contrary to our common obſervation happens, and that is thus, if you mix with *Oyl* of *Vitriol* a quantity of *water*, a great *heat* will follow without an *Expantion* of theſe *Liquors*, whereas *heat* do's conſtantly produce it in *Wine*, *Water*, and moſt fluid and ſolid bodies; for here it rather ſhrinks and condenſes, as you may ſee by making the *Experiment* in a Glaſs with a long Neck, and ſetting your *mark* as ſoon as you make your *mixture*. Both theſe *Inſtances* may a little *puzzle* the *Car-*

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*teſian Hypotheſis* to account for, tho I am far from thinking they are able to deſtroy them. But to proceed with our *Experiment*, after I had ſufficiently ſatisfied the worthy *Spectators*, that the produced degree of *Cold* was very conſiderable, I then poured in ſome few drops of another *Liquor*, that ſoon alter'd the *temper* of our *Cold mixture* and in two or three *Minutes* brought it to a *warmth* beyond that of the *Ambient Air*, tho it was a very warm Sun-ſhining day, in *July*.

To apply the *Experiment*. In the *Cold* Fit of an *Ague* we have often a ſtrong and quick Pulſe, which argues an *Ebullition* (tho I dare not call it an *Efferveſcence*) and quick motion of the *Blood*, and the pains of the head and other parts may be due, to too great diſtreſs or extenſion of the Veſſels, which depends on the expanſion of the boyling humours. In this artificial tho *cold* mixture we obſerve, a mighty commotion and high Ebullition and expanſion of the *Liquor*. In the *Blood* and other *Juices* of the body we conſtantly diſcover great quantities of *volatile Salts*, and ſometimes either from an infected *Air*, or bad *dyet*, and from ſeveral other cauſes, ſour *Juices* may be derived to the *blood*, which may act upon theſe volatile Salts, the blood ſo much abounds with, as to give a notable ſenſe of *cold*. It is no new thing for us to meet with *Patients*, that have thrown upon their *Stomacks* and *Bowels* (which are the great *Emunctories* of the Blood) very *ſour Liquors*, ſuch as when they happen to fall upon the *Teeth* will corrode thoſe hard parts. Thus in our *Experiment* tis plain that a forreign *acid* meeting with a *volatile Salt* drawn from the *blood*, does produce a *cold effect*; and ſince we know no *Liquors* but a *mixture* of this *kind* that gives us ſuch a *cold Phænomenon*, it ſeems not unreaſonable to believe that the *cold* Fit of an *Ague* may be due to ſuch a *mixture*.

As to the *Incaleſcence* made in our mixture, I ſhould have told you that it was done by the bare addition of ſome drops of *Oil* of *Sulphur per Campanam*, being a Liquor

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that owes its *Origine* to the *fire*, I ſuppoſe it to have borrowed that *Calorifrick* qualitie thence, which made it repreſent the *hot Fit* : for this I obſerved that notwithſtanding the action of the *Cold* mixture, it grew more thick and ſlimy than twas at firſt, and that the addition of the mention'd *Oil*, or *Spirit* of *Brimſtone* made it more clear and fluid. Thus the agile Spirits of the humane body, which tho they cannot be thought to be actual *fire*, yet are ſuppoſed to be ſomewhat *Analogous* to it, being in more abnndance poured into the turbid Maſs of Blood, do by their warmth and action firſt attenuate thoſe groſs *Coagulums*, and then manifeſtly ſubdue, and reduce many of thoſe indiſpoſed Particles to a good *Texture*, and expel thoſe that are diſagreeable by *Sweat* and *Vrine* or both ways ; which is a good *Prognoſtick* of a *cure* of that *Paroxiſm*.

I ſhall only add this Objection made, *viz. That there are no ſuch Acids of ſo high a degree of Acidity found in the human body as we make our Experiments with.*

I may anſwer that there is no need alſo of ſo great a degree of *Cold* to put our blood into an *Ague*, a ſmall *declination* from its uſual *Temperature*, being ſufficient to make us very ſenſible.

Poſtſcript

# Poſtſcript.

I ſhall here only hint by way of *Poſtſcript* an ingenious *Propoſition* of a very worthy *Perſon* of the *Society*, to try whether the *Cortex Peruvianus* would not prevent this *Artificial Ague* our Liquors produced: which we brought to Tryal, tho the ſucceſs did not anſwer. For we made a ſtrong Infuſion of our *Bark* in common Vinegar and then injected a quantity of the mention'd *volatile Salt*, a conſiderable Commotion of the *Liquor* inſued with a degree of *Cold*, but was not altogether ſo fierce as formerly, moreover it abated much of riſing to the heigth of the former Experiment, when *Opium* was mixt with the mention'd *Cortex*: tho in this caſe the *Acidity* was far from being quite mortified. As to the *Cortex* I do not intend in this *Experiment* to explain its *Nature*, which was only made to ſatisfy that ſagacious *Gentleman*'s Curioſity: for I never thought that *febrifuge* did act the part of an *Alkali* in performing the *Cure*. But if I can make it appear that there are other *Medicines* that do pertain or belong to the families of *Alkaly's*, which are effectual in the *cure* of *Agues*, this may ſerve to prove, that they do it by deſtroying ſome morbid *Acidities* in the humours or *Viſcera*, and ſo prevent the uſual Commotions ſuch *diſagreeable Liquids* are apt to make upon their *Conventions*. This is manifeſt that *Coral* and *Crabs eys* and other *Teſtaceous* bodies number'd amongſt the fixt *Alcaly's* and not only theſe but thoſe real *fixt salts*, as *Sal Abſinthij*, *Cardui benedicti* &c. as well as the *volatile Salts* in general, do highly correct and change *Acid humours* where they can meet them, and not only ſo but do hinder Liquors that are apt to ſour and corrupt from degenerating: (thus Milk and Blood it ſelf may be preſerved much longer; the firſt from growing ſour, the laſt from fermenting and putrifying by a quantity of *volatile Salt* or *Spirit* mixt with them :) which is in like manner granted to be true, that many *Agues* have been cured by *Medicines* of this Nature, *Sal Abſinthij* as well as *volatile Salts* are uſed as the principal *Ingredients* in common *Febrifuges.* For a farther proſecution of this *Experiment,* we diſſolved as much *Chalk* as ſtrong *Vinegar* was able to do, and then having ſtrained it through a *Filter*, we poured it upon a quantity of the highly rectified *Spirit* of *Blood*, but found neither *Ebullition*, or any ſenſation of *cold* or *heat* to follow.

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